PROC. ENTOMOL. SOC. WASH.
108(3), 2006, pp. 726–729

Note

Four New Host Records for *Amblyomma geoemydae* (Cantor) (Acari: Ixodida: Ixodidae) from Captive Tortoises and Freshwater Turtles (Reptilia: Testudines) in the Turtle Conservation Center, Cuc Phuong National Park, Vietnam

There are 23 native species of tortoises and freshwater turtles in Vietnam, and all of them are threatened with extirpation due to insatiable Chinese market demand and widespread, accelerating habitat destruction (Hendrie 2000). Responding to this crisis, in 1998 Fauna and Flora International, in cooperation with the Vietnamese Ministry of Agriculture and Rural Development, formally established the Turtle Conservation Center (TCC) at Cuc Phuong National Park, in the northern part of the country (20°14–20°24′N, 105°29–105°44′E). The TCC is charged with promoting awareness of threats to Vietnam's native turtles, training wildlife protection officers, and establishing a conservation breeding program for critically endangered species. Currently, the TCC encompasses $\approx$ 2,000 m^2, with more than 50 outdoor enclosures for terrestrial species, and several dozen aquatic and semi-aquatic enclosures, including six "free-ranging" enclosures with functioning streams and constructed wetlands. Enclosures measure from 1 m^2 to $>$ 84 m^2, the larger ones having been designed to represent near-natural environments, with an abundance of leaf litter, shelter sites, and native vegetation (Calle and Hendrie 2003, Hendrie 2003, Calle et al. 2005). Between March 2003 and March 2004, we were able to obtain 75 tick collections, comprising 1,515 specimens, from 5 of the 17 captive tortoise and turtle species then held at the TCC (all seized from illegal traffickers): the Indochinese box turtle, *Cuora galbinifrons* (Bourret); the three-keeled box turtle, *C. mouhotii* (Gray); the yellow-headed temple turtle, *Hieremys annandalii* (Boulenger); the elongated or yellow tortoise, *Indotestudo elongata* (Blyth); and the impressed tortoise, *Manouria impressa* (Günther). The vast majority of tick specimens (98 ♂, 93 ♀, 1,031 nymphs, 286 larvae) removed from these hosts were *Amblyomma geoemydae* (Cantor). In addition, 4 ♂ and 3 ♀ of *Amblyomma supinoi* Neumann were taken from 1 ♂ and 1 ♀, respectively, of *I. elongata*, the principal host of this uncommonly collected tick (Robbins and Platt 2001). All ticks were preserved in 70–80% ethanol and shipped to RGR for identification and analysis, prior to deposition in the Division of Entomology, Peabody Museum of Natural History, Yale University, New Haven, Connecticut.

Published records of *A. geoemydae* exist for the yellow-margined box turtle, *Cuora flavomarginata* (Gray); *C. mouhotii*; the Asian leaf turtle, *Cyclemys dentata* (Gray); the black-breasted leaf turtle, *Geoemyda spengleri* (Gmelin); the spiny turtle, *Heosemys spinosa* (Gray); the Travancore tortoise, *Indotestudo travancorica* (Boulenger); the Asian brown tortoise, *Manouria emys* (Schlegel and Müller); the Japanese turtle, *Mauremys japonica* (Temminck and Schlegel); and the Indian black turtle, *Melanochelys trijuga* (Schweigger) (Simmons and Burridge 2000). Thus, four of the five testudines examined for ticks at the TCC provided new host records for *A. geoemydae*, and the 27 tick collections made from these hosts are listed in Table 1. Significantly, our two new host tortoises—*I. elongata* and *M. impressa*—appear in Appendix II (species not necessarily threatened with extinction but that may become so unless trade is

Table 1. Collections of *Amblyomma geoemydae* from previously unreported hosts at the Turtle Conservation Center, Cuc Phuong National Park, Vietnam, 12 March 2003-17 March 2004 (Cg = *Cuora galbinifrons*, Ha = *Hieremys annandalii*, Ie = *Indotestudo elongata*, Mi = *Manouria impressa*; N = nymph, L = larva).

Tortoise/Turtle No./Sex	Tick Totals	Tick Attachment Sites	Date
Cg31, ♀	1 ♂	no data	15 April 2003
Ha4, ♂	2 ♂ 1N	carapace, neck, tail	21 March 2003
Ie15, ♂	1 ♀	carapace	10 November 2003
Ie32, ♀	1 ♀	rear leg	12 March 2003
Ie33, ♀	1 ♀	carapace	20 October 2003
Ie34, ♀	1 ♀	carapace	9 April 2003
Ie93, ♀	1 ♂	carapace	20 October 2003
Ie170, ♀	1 ♀	rear leg	5 June 2003
Ie268, ♂	1 ♂, 1 ♀	carapace, tail	30 March 2003
Ie305, ♀	3 ♂	carapace	20 October 2003
Ie314, ♂	1 ♂	carapace	13 March 2003
Ie365, ♂	4 ♂, 1 ♀	carapace, plastron	15 October 2003
Ie416, ♀	2 ♂, 1 ♀	carapace	15 October 2003
Ie424, ♀	5 ♂	carapace, plastron	15 October 2003
Ie425, ♂	2 ♂	carapace	20 October 2003
Ie428, ♂	1 ♀	plastron	4 October 2003
Ie459, ♀	1 ♂	plastron	15 October 2003
Ie589, ♂	1 ♂	carapace	30 March 2003
Ie643, ♀	1 ♂	carapace	11 April 2003
Ie649, ♀	1 ♂	carapace	20 October 2003
Ie651, ♀	2 ♂	carapace	20 October 2003
Ie661, ♂	1N	front leg	20 August 2003
Ie662, ♂	3N	front leg, neck	20 August 2003
Ie663, ♀	2 ♂, 3 ♀, 1N	carapace, plastron, rear leg	20 August 2003
Ie664, ♂	6 ♀, 27N	front leg, neck, plastron, rear leg	20 August 2003
Ie717, ♀	1 ♀	rear leg	17 March 2004
Mi25, ♀	4 ♂ 2 ♀, 60N, 16L	carapace, front leg, neck, rear leg	17 March 2003

strictly regulated) of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (van Dijk et al. 2000), a signal that opportunities to investigate similar host-parasite relationships may be fading.

Amblyomma geoemydae is chiefly a tick of southern and southeastern Asia, most records having come from peninsular and insular Malaysia (Sabah, Sarawak), Indonesia (Java, Kalimantan Borneo, Sumatra), the Philippines, Singapore, Thailand, and Vietnam (Tanskul et al. 1983, Kolonin 1995, Petney and Keirans 1995, Voltzit and Keirans 2002). In eastern Asia, this species is known from southern Japan (Kyushu and the Ryukyu Islands) and Taiwan (Yamaguti et al. 1971, Robbins 2005). An unpublished collection from Sri Lanka (U.S. National Tick Collection No. RML 106681) and recent records from the Western Ghats of India (states of Karnataka and Kerala) suggest that *A. geoemydae* may occur in all countries bordering the Bay of Bengal (Vijaya 1983, Frazier and Keirans 1990). Among the most distinctive amblyommines in Asia (the female foveae are unusually large and the nymphal scutum is conspicuously or-

Table 2. Non-testudine hosts of *Amblyomma geoemydae* specimens in the U.S. National Tick Collection.

Host	Location	Tick Stage(s)
Reptiles		
Python reticulatus (Schneider)	Malaysia: Johor	♀, N, L
Varanus dumerilii (Schlegel)	Malaysia: Johor	N
Varanus salvator (Laurenti)	Malaysia: Johor, Perak, Sabah, Selangor Thailand: Tak	♂, ♀, N
Birds		
Anthracoceros malayanus (Raffles)	Malaysia: Pahang	N
Centropus sinensis (Stephens)	Malaysia: Pahang	N
Ceyx erithacus (L.)	Malaysia: Negeri Sembilan	N
Dupetor flavicollis (Latham)	Malaysia: Pahang	L
Lacedo pulchella (Horsfield)	Thailand: Nakhon Si Thammarat	N
Napothera macrodactyla (Strickland)	Malaysia: Negeri Sembilan	N
Pitta brachyura (L.)	Malaysia: Pahang	N, L
Pitta moluccensis (Statius Müller)	Malaysia: Pahang	L
Pitta sordida (Statius Müller)	Malaysia: Negeri Sembilan, Pahang	N, L
Platylophus galericulatus (Cuvier)	Malaysia: Selangor	N
Rhizothera longirostris (Temminck)	Malaysia: Kelantan	N
Stachyris poliocephala (Temminck)	Malaysia: Negeri Sembilan, Selangor	N
Zoothera marginata Blyth	Thailand: Chanthaburi	N
Mammals		
Arctogalidia trivirgata (Gray)	Malaysia: Perak	♀
Hemigalus derbyanus (Gray)	Malaysia: Terengganu	N
Homo sapiens L.	Indonesia: Sumatra Malaysia: Sarawak	♀
Manis crassicaudata Gray	Sri Lanka	♀
Pardofelis marmorata Martin	Thailand: Nakhon Ratchasima	N
Sus scrofa L.	Malaysia: Johor, Kedah, Kelantan, Pahang, Perak, Selangor	♂, ♀, N

nate), *A. geoemydae* principally parasitizes testudines, though other reptiles and, occasionally, mammals may serve as hosts of all stages, while birds are sometimes infested by immatures (Hoogstraal and Aeschlimann 1982). Non-testudine hosts of specimens in the U.S. National Tick Collection are summarized in Table 2. Despite the diversity of apparently suitable host species, no disease agents have been associated with bites of this tick. We anticipate that ongoing studies at the TCC will yield additional new host records for *A. geoemydae*, as well as data on tick population dynamics.

We thank the officers of Cuc Phuong National Park and the staff of the TCC for their assistance in making and shipping our tick collections. Thanks also to the Wildlife Conservation Society's Field Veterinary Program for invaluable logistical support. Dr. James E. Keirans, former Curator of the U.S. National Tick Collection, Institute of Arthropodology and Parasitology, Georgia Southern University, Statesboro, kindly supplied all records of *A. geoemydae* in his care. This study was supported by a grant from the Conservation Endowment Fund of the American Zoo and Aquarium Association and by the Wildlife Conservation Society's Health Sciences Division.

Literature Cited

Calle, P. P. and D. Hendrie. 2003. Development of a chelonian health care program at the Turtle Conservation Center, Cuc Phuong National Park, Vietnam. Proceedings of the Association

of Zoo Veterinary Technicians, 23rd Annual Meeting, New York, New York, 24–28 August 2003, p. 75.

Calle, P. P., B. L. Raphael, J. L. Behler, W. Holmstrom, D. McAloose, M. D. M. Busch, J. S. Spratt, T. M. Norton, D. B. Hendrie, and B. D. Phong. 2005. Development of a chelonian health care program for the Turtle Conservation Center, Cuc Phuong National Park, Vietnam. Proceedings of the Association of Reptilian and Amphibian Veterinarians, 12th Annual Conference, Tucson, Arizona, 9–14 April 2005, pp. 17–18.

Frazier, J. G. and J. E. Keirans. 1990. Ticks (Acari: Ixodidae) collected on chelonians (Reptilia) from India and Burma. Journal of the Bombay Natural History Society 87: 247–249.

Hendrie, D. B. 2000. Status and conservation of tortoises and freshwater turtles in Vietnam, pp. 63–73. *In* van Dijk, P. P., B. L. Stuart, and A. G. J. Rhodin, eds. Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia. Chelonian Research Monographs 2. Chelonian Research Foundation, Lunenburg, Massachusetts.

———. 2003. Turtle Conservation Indochina. Newsletter of the Turtle Conservation and Ecology Program [sic] (TCEP). Accessed on the Worldwide Web at URL <http://www.asianturtlenetwork.org/library/reports/TCEP_newsletter_june_2003.pdf>, September 2005.

Hoogstraal, H. and A. Aeschlimann. 1982. Tick-host specificity. Mitteilungen der Schweizerischen Entomologischen Gesellschaft/Bulletin de la Société Entomologique Suisse 55: 5–32.

Kolonin, G. V. 1995. Review of the ixodid tick fauna (Acari: Ixodidae) of Vietnam. Journal of Medical Entomology 32: 276–282.

Petney, T. N. and J. E. Keirans. 1995. Ticks of the genera *Amblyomma* and *Hyalomma* from South-east Asia. Tropical Biomedicine 12: 45–56.

Robbins, R. G. 2005. The ticks (Acari: Ixodida: Argasidae, Ixodidae) of Taiwan: A synonymic checklist. Proceedings of the Entomological Society of Washington 107: 245–253.

Robbins, R. G. and S. G. Platt. 2001. First report of *Amblyomma supinoi* Neumann (Acari: Ixodida: Ixodidae) from the Arakan forest turtle, *Geoemyda depressa* Anderson (Reptilia: Testudines: Emydidae), with additional records of this tick from the Union of Myanmar. Proceedings of the Entomological Society of Washington 103: 1023–1024.

Simmons, L.-A. and M. J. Burridge. 2000. Introduction of the exotic ticks *Amblyomma humerale* Koch and *Amblyomma geoemydae* (Cantor) (Acari: Ixodidae) into the United States on imported reptiles. International Journal of Acarology 26: 239–242.

Tanskul, P. (L.), H. E. Stark, and I. Inlao. 1983. A checklist of ticks of Thailand (Acari: Metastigmata: Ixodoidea). Journal of Medical Entomology 20: 330–341.

van Dijk, P. P., B. L. Stuart, and A. G. J. Rhodin, eds. 2000. Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia. Chelonian Research Monographs 2. Chelonian Research Foundation, Lunenburg, Massachusetts, 164 pp.

Vijaya, J. 1983. First report of *Amblyomma geoemydae* from India. Hamadryad 8: 13.

Voltzit, O. V. and J. E. Keirans. 2002. A review of Asian *Amblyomma* species (Acari, Ixodida, Ixodidae). Acarina 10: 95–136.

Yamaguti, N., V. J. Tipton, H. L. Keegan, and S. Toshioka. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young University Science Bulletin, Biological Series 15: i–iv, 1–226.

Richard G. Robbins, Bui Dang Phong, Tim McCormack, John L. Behler, Hendrik A. Zwartepoorte, Douglas B. Hendrie, and Paul P. Calle. *(RGR) Armed Forces Pest Management Board, Walter Reed Army Medical Center, Washington, DC 20307-5001, U.S.A. (e-mail: richard.robbins@osd.mil); (BDP) Turtle Conservation Center, Cuc Phuong National Park, Vietnam (e-mail: phongtccucphuong@gmail.com); (TM) Turtle Conservation Center, Cuc Phuong National Park, Vietnam (e-mail: the_agent_badger@yahoo.co.uk); (JLB) Department of Herpetology, Wildlife Conservation Society and IUCN/SSC Tortoise and Freshwater Specialist Group, 2300 Southern Boulevard, Bronx, NY 10460-1099, U.S.A. (e-mail: jbehler@wcs.org); (HAZ) Rotterdam Zoo and Turtle Survival Alliance-Europe, Rotterdam, The Netherlands (e-mail: h.zwartepoorte@rotterdamzoo.nl); (DBH) Wildlife Conservation Society and Cleveland Metroparks Zoo, 3900 Wildlife Way, Cleveland, OH 44109-3187, U.S.A. (e-mail: dhendrie@fpt.vn); (PPC) Wildlife Health Sciences, Wildlife Conservation Society, 2300 Southern Boulevard, Bronx, NY 10460-1099, U.S.A. (e-mail: pcalle@wcs.org)*